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Solution of Sn Radiation Transport Using Unstructured Grids on Parallel Computers*

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Abstract

There are several different approaches to parallelization of Sn Radiation Transport: decomposition over energy groups, decomposition over angles, and decomposition over the spatial domain. The first two approaches are easy to apply and provide excellent speed-ups with minimal communication overhead. The latter approach is more difficult: significantly more inter-processor communication is required, and optimally decomposing the spatial domain in a manner which minimizes communication is non-trivial.

To decompose the spatial domain we use a recursive spectral bisection method (H. Simon, et. al.). This method is close to optimal and is quite efficient for grids which are not extremely large.

A multilevel iterative method with diffusion or low-order Sn acceleration is the method used for solving the nonlinear Sn radiation transport equations. Inter-processor communication is required after sweeping the grid for all angles to calculate the angular fluxes.

Reasonable scaling and speed-ups with increasing numbers of processors are obtained until the number of spatial grid cells being computed by each processor becomes relatively small. The scaling results have been performed on the LLNL 224 node Meiko CS-2 computer.

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